

It was stated, in the course of discussion, that should this plan be found to answer, unlimited speed might be obtained; it could traverse the sides of roads without frightening horses, go through towns, and by means of side-wheels, &c., go round such curves, at a high rate of speed in perfect safety, which were now impassable. It was also observed that the great obstacle to a railway across the Isthmus of Suez was, that it would be speedily blocked up with sand, which difficulty this covered way would entirely obviate.

Mr. EATON HODGKINSON read a paper entitled "Investigations undertaken for the purpose of furnishing data for the construction of Mr. Stephenson's Tubular Bridges at Conway and the Menai Straits." Mr. Hodgkinson commenced by acknowledging that to Mr. R. Stephenson is due all the merit of the invention of the tubular bridges, and that himself and Mr. Fairbairn were employed by that gentleman to carry out his designs by making experiments on a great practical scale. Some of the various experiments undertaken, and their results, were mentioned, but the formulae deduced from them were merely exhibited, as they will be published in the *Transactions* of the Association. In trying the transverse strength of wrought-iron, it was found that the upper part of the tube wrinkled before it broke; and then Mr. Hodgkinson thought of giving increased strength by placing a number of small tubes at the top of the larger one. This mode was adopted with advantage, and the tubular bridge was constructed with rows of cells at the top and at the bottom. It was ascertained that a tube so constructed would safely bear 8 tons on the square inch, and even 12 tons might be placed on it without much danger, though the metal sometimes crimped up at that pressure. In the experiments, it was found that circular tubes withstood more weight than square ones, though for several practical purposes it was deemed best to adopt the rectangular shape. The form of the tube was not, however, finally determined till February in last year. In the bridge, as constructed, it would require a weight of 1084 tons, including its own weight, to produce a pressure of 8 tons to the square inch.

In the same section Mr. BUDD described the process adopted at the Ystalyfera Iron-Works, of applying the heated gases that escape from the furnaces, which plan those who accompanied the excursion up the Swansea Valley had an opportunity of witnessing in practical operation, as before mentioned.

After the business in the various sections had closed for the day, the general committee met, by adjournment, to appoint the next place of meeting. Numerous letters of invitation, from the public bodies and societies in Birmingham, were read, and that town was unanimously selected for the next meeting, which is to be held some time in September. Invitations from Bath, Ipswich, and Derby, were also read. Dr. Robinson, of Armagh, was appointed the president of the next meeting; and the Earl of Harrowby, Lord Wrottesley, Mr. Darwin, Prof. Faraday, and Professor Willis, were appointed vice-presidents. The treasurer and secretaries were re-appointed, as a matter of course.

In the evening, Dr. CARPENTER delivered, in the place for holding the general meetings, a discourse on recent microscopical discoveries. Great varieties of beautifully executed drawings of objects, as magnified by the microscope, were exhibited, to form illustrations of the subject. The discourse was listened to by a large audience.—At its termination, Dr. MANTELL was called on by the President, and he added to Dr. Carpenter's account of the formation of chalk, that the bodies of the animalcules which inhabited the shells composing the chalk, are still enclosed within them—being the mummies of a former world.

One of the most interesting of the excursions was that to Penllergare, the mansion of J. D. Llewellyn, Esq., distant about five miles from Swansea. The favourable weather made the drive to and fro, and the promenade in the grounds and on the shores of the lake truly delightful. A boat, which was impelled by the electrical current, was, however, the principal object of attraction. It was not constructed for the purpose, but was the boat ordinarily used on the lake for pleasure, capable of conveying about six persons. In the bow of the boat a galvanic battery was placed, which having connecting wires, with a small retort filled with mercury at the stern, enabled the professor, who steered the boat, to connect or disconnect the circuit of the fluid as he pleased. Near the centre was a solid cylinder, constructed of wood, but bound with copper, which revolved on its axis, and from which electric sparks were freely emitted. This cylinder was in a state of continuous revolution, and with the cylinder a rod was connected, which caused the fans placed at the stern of the boat to revolve. The application of electric locomotive power is, doubtless, a question of great interest, but it is chiefly a question of expense and speed combined. The boat is ordinarily paddled from the stern, with one oar; its progress is slow as compared with that of the Thames wherries; the battery required to work it is a powerful one, and yet the progress which it made in its excursion round the lake was not swifter than that which it would make with ordinary paddling. At present it is a scientific toy; but it clearly establishes the principle that electricity can be converted into a motive-power for the propulsion of vessels, thereby saving the space at present occupied by the engines and fuel; and, as the power can be indefinitely increased so as to meet the required speed, the sole question is one of expense.

Aug. 15.—In the mathematical and physical section, Prof. PHILLIPS read a report of the progress of anemometrical researches; in which he described his further experiments with a new anemometer, constructed on the principle of evaporation. Owing to the mechanical difficulties which prevent the attainment of accuracy in measuring the force of wind at low velocities by the common instruments, Mr. Phillips conceived that the rate of evaporation might afford a better gauge of the velocity of the wind than mere impact. He tried various experiments with two thermometer bulbs, the one being wetted and the other dry; and from the reduction in temperature of the mercury in the wetted bulb by evaporation, he endeavoured to obtain some approximate results. The experiments were, to a certain extent, satisfactory, and showed that the principle is capable of being applied as a measure of the velocity of wind, but still they were not of such a nature as to be always depended upon. Mr. Phillips observed a remarkable, and hitherto unaccountable, variation previous to a change of weather; he then proceeded to improve on the instrument, by causing the wind to act on a nicely balanced vane, the arms of which were 3 ft. long, and at the ends of which were placed hemispherical cups, containing water. The least breath of air was sufficient to give rotary motion to the vane. With a brisk wind it rotated rapidly, and thus became exposed to the evaporating action of the air in much greater degree. The instrument is not yet perfected, but Mr. Phillips hopes, after further trials, to render it a sensitive and accurate measure of the velocity of the wind.

In the same section, Sir D. BREWSTER mentioned some curious facts relative to the vision of objects during rapid travelling. On looking out of the window of a railway carriage, for instance, if the eye be fixed on a row of stones, or of pailings, the image seems confused, and to be rapidly moving away; but if the axis of the eye be suddenly turned to some nearer spot, then the stones, or pailings, are for an instant distinctly seen stationary. Sir D. Brewster said, he could not yet account for the phenomenon. Dr. Whewell, and other members, mentioned similar instances of optical illusions, with a view to explain the cause, but Sir David was of opinion that the cases mentioned were not parallel.

In the chemical section, Dr. PERCY read a valuable paper, detailing experiments concerning the extraction of silver from some of its ores in the wet way; but the results of minute analysis and technical descriptions of the chemical processes, however useful when in print, presented no features to attract an audience. Dr. Percy stated, that some silver ores, containing as much as 30 per cent of silver, had been sent to Swansea, from South America, to be smelted, and South Wales might in time become as celebrated for its silver works as it is now for its copper works.

The geological section was occupied for a long time with the reading of a paper, "On the Geology of Pennsylvania," by Prof. Rogers, from America. The slow imperturbable manner with which Dr. Rogers proceeded, indicated the great length to which his discourse would run. It was illustrated by numerous drawings; but Mr. Lyell has so fairly described the geological features of the country in preceding years, as to completely exhaust the subject. The American tendency to exalt the merits and products of his own country was very evident in Prof. Rogers, who stated that the iron annually obtained in the state of Pennsylvania amounted to 700,000 tons, which exceeded the produce of the whole of South Wales.

In the mechanical section, Mr. F. WHISHAW exhibited and explained his uniformity of time telegraph. In this telegraph two chronometers are employed, which must be regulated so as to keep time exactly together, one at each station. The second hand is prolonged, and as it moves round, it points at each second to some sentence printed radially on a dial, through the centre of which the second hand appears. In transmitting a message to a distance, it is requisite there should be a communication by an insulated wire, for the purpose of transmitting instantaneous signals by electricity. Thus, when the hand of the chronometer points to a question required to be answered, the operator instantly completes the electrical circuit, and by that means strikes a bell at the distant station. The operator at the distance, being on the alert to watch, observes the question to which the hand points, since both hands as they move round are supposed to be pointing to exactly the same sentences. He then answers the question, if it be contained on the dial, by a similar process, and in two minutes' time a question and answer might thus be transmitted. As various codes are printed on moveable dials, containing a vast variety of subjects, it is supposed that by this means the purposes of telegraphic communication might be easily effected. The difficulties to be encountered would be the exact regulation of the chronometers, which might be done by electric signals, and the quickness of observation and action required in the operators.

[To be continued in the Mining Journal of next week.]

LEEDS AND THIRSK RAILWAY.—On Monday last trial trips were made on a further portion of this line—namely, Wormald-green, near Kipon, to Starbeck, on the highway from Harrogate to Knaresborough, and it is expected to be opened for traffic during this month. The viaduct on this line, at the Crimble Valley, is rapidly approaching completion, when a further distance, extending to Wootton, near Harewood Bridge, will be ready for opening.

WALKER'S PATENT HYDRAULIC ENGINE.

This new engine, for draining or irrigating lands, may be seen at work at Mr. Walker's factory, City-road, any day, raising 7000 gallons of water per minute, 4½ feet high. It is intended for the drainage of an estate of 500 acres, in Norfolk; and, when it leaves the factory, will have two steam-boilers, 15 feet long and 3½ feet diameter, which will enable it to discharge 6000 gals. a minute, or 4,320,000 gallons a day, 10 feet high, at a daily working cost of about 12s. 6d. per day—the original cost being from 600l. to 650l.

Q is the water cylinder, the piston of which works in the water contained in a quadrangular iron well, resting on the frame, A, and covered by the framework, E, not all shown. The well has three openings, one in front, and one on each side, fitted with sluice doors, hinged on their upper edges—one or more of which can be opened or closed at pleasure. On the upper flange of the well rests a strong frame of timber, E E, from which stays pass down to the foundation timbers, and give stability to the superstructure. Upon the frame, E E, are erected cast-iron framed standards, F F, secured to the well, by nuts and bolts passing through the frame, E E.—The standards, F F, are in two heights, and upon a flooring at G G, there are two steam-cylinders at H—one only seen—with pistons, each of which is connected by two piston-rods, h h, to its respective crosshead, I. From a bolt in the centre of the crosshead, I, which works in guides in the side framing of the standards (not shown in the figures), a connecting-rod passes up to a crank on the outer end of the shaft, which shaft carries a fly-wheel, L. From the outer ends of the crosshead, I, two connecting-rods, M M, pass down to a large crosshead, N, beneath the steam-cylinders; from this crosshead two other rods, n n, pass down, and are bolted to a cruciform platform, o o. Upon the platform, o o, are bolted four upright iron-rods, p p p p, the upper extremities of which support a valve piston. Immediately beneath the steam-cylinders, and supported by their upper flanges, upon the frame, E E, are two water-cylinders, Q, open at the bottom, and having at top a valve, opening upward. Upon the upper flanges of the water-cylinders, Q, is bolted a valve-box, R, communicating by an exit-main, s, with what is termed a dividing-box, S, furnished like the well before described, with doors on each side, and in front capable of being opened and closed at pleasure. On the top of the valve-box are covering plates, r, the removal of which gives access to the cylinder-valves. Steam from a boiler is admitted through the induction-pipe to a slide-valve, T, placed beneath and between the steam-cylinders, by means of which the steam is admitted alternately to the bottom of each. The slide-valve, T, is worked by an eccentric, on the crank-shaft. The steam-cylinders, H, are fitted with cones, through which the piston-rods, h h, work; the hot-air passing from the upper part of one to the other through an air-tube, as the pistons alternately rise and fall. After leaving the cylinders, the waste steam passes from the slide-valve, T, along the eduction-pipe, through the water-box, Z, whence it passes into the pipe, z, which may be led into a chimney, or other convenient outlet. The cold water, raised by a pump, flows into the upper part of the water-box, Z, and into the tubes, which descend nearly to the bottom thereof, where it becomes heated (by the spent steam passing through the box), nearly, or quite, to the boiling point, in which state it is forced into the boiler by the feed-pump.

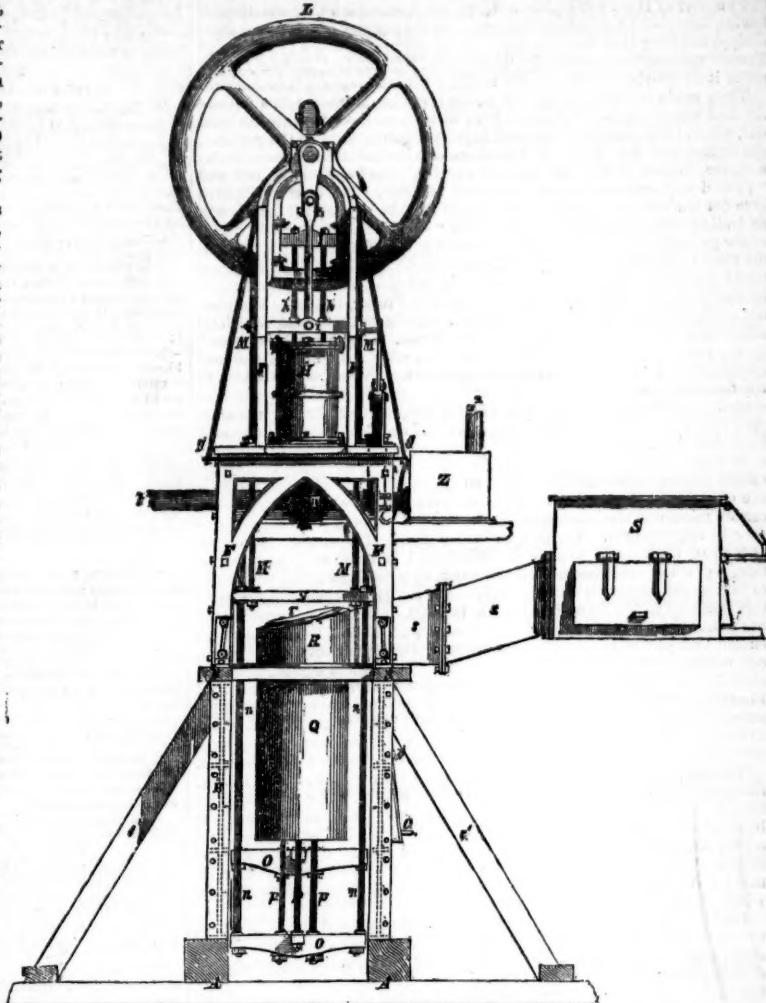
The following is the *modus operandi*:—The steam in a boiler being at a pressure of 25 lbs., or thereabouts, upon the square inch, is admitted to the slide-valve, T, through which it passes into one of the steam-cylinders beneath the piston that happens to be in the position for making the upward stroke. The pressure of the steam raises the piston, which, by means of the piston-rods, h h, crossheads, I and N, and connecting-rods, M M, and n n, already described, lifts the valve piston, and expels any air or water that may be above it, through the valve at the top of the cylinder, Q. The opposite steam and water-pistons at the same time descend, by virtue of their connection with the crank-shaft; the air, or steam, beneath the steam-piston, escaping through the eduction port to the waste steam-pipe. On completing the stroke, the movement of the slide valve reverses the ports and admits the steam into the other cylinder—the piston of which is in like manner raised; and the water that is now above the second piston is thrown forcibly upward through the valve at the top of the cylinder, and passes off by the exit-main, s, to the dividing-box, S; by this movement, an ascending current of water is generated in the cylinder; and when the motion of the piston, P, is reversed, and it begins to descend, its valves open; and the upper current of water, generated as before described, passes through the valve, until the piston, P, has traversed a greater or smaller portion of its downward stroke, according to the momentum acquired by the water, which will be in proportion to the velocity with which the piston travels.

When the engine is employed for draining land, one or more of the sluice doors are opened, communicating with the drains from which the water is to be taken. The side doors of the dividing-box, S, are closed, and the front are opened, communicating with the channel, by which the water is to be got rid of. On the contrary, if water is to be raised from a river, or other external source, and thrown into the ditches for irrigation, or other purposes, a different sluice-door of the well, communicating with the river, is opened, and those communicating with the drains shut. The front sluice of the dividing-box, S, is also shut, and the side ones, leading to the drains, or ditches, opened. By thus regulating the sluices, the engine can be employed to lift water out from, or into, the land at pleasure. In erecting this machine, it is to be observed, that the lower orifice of the water-cylinder, Q, should not be higher than the lowest part of the drain, from which the water is to be taken, as the machine ceases to raise the water, when it falls below the bottom of the cylinder.

[The *Mechanics Magazine* of last week contains a very lengthy description of Mr. Walker's engine, from which the above notice is abridged.]

THE VICTORIA MINE, DERBYSHIRE.—At the Barmote Court, Wirksworth, on Wednesday last, the 16th inst., held before W. E. MOUSLEY, Esq., Steward, in the case "Fearn an Infant by his next Friend v. Spencer and Partners," The plaintiff claimed title to one-half of Ball Rake, afterwards entered Victoria Mine, under a variety of changes of title to Gould and others; and from the Gould's ultimately to the plaintiff, an infant (who sued by his next friend), Benjamin Tomlinson was called, who proved himself to be the original owner of the mine; that he then transferred certain interests in it to Gould and others, and two pieces of paper were put in, signed by marksmen, to show the title under which the present plaintiff claimed. This was objected to by Mr. HODGKINSON, on the ground that the two pieces of paper were not stamped according to the Stamp Act, when a long argument took place between Mr. MACQUEEN and Mr. HODGKINSON, as to the mineral customs, and the laws relating to stamp duties, and several cases were cited showing the dicta of the Lord Chief Baron upon the subject.—At the conclusion of these arguments, the STWARD said he must consult the plaintiff from the evidence adduced, on the ground that any interest passing out of lands or hereditaments from one person to another, must, according to the statute of frauds, be in writing, and, being in writing, it was necessary that the papers produced should be duly stamped, as a transfer of such interest. The Legislature having wisely provided by a statute, to prevent frauds and injuries, that all transfers and conveyances of lands or hereditaments or interest in lands, should be duly stamped, according to the provisions of the Stamp Act, to prevent a fraud upon the revenue. The STWARD, however, said that although he directed a nonsuit in the present case, he would grant a new trial, to enable the parties, if they thought fit, to further investigate the question at issue, and the costs of the present cause should abide the event of such new trial, if prosecuted without delay.

COPPER DUTIES.—In the House of Commons, on Monday, Lord G. BENTINCK presented a petition from the miners, traders, and artisans connected with one of the largest mines in Cornwall, complaining of the present position of the copper trade as one of great depression—the price of copper having fallen 25 per cent. below the average of 15 years; and praying that the bill pending before the House for altering the copper duties might not pass, as it would reduce the petitioners, and all persons connected with copper mining, to utter ruin.



EXPLOSIONS OF GAS IN METALLIC MINES.

The explosions of gas, unfortunately so frequent in coal mines, have not, heretofore, been mentioned, at least to my knowledge, in metalliferous deposits. I, therefore, publish a record of several accidents of this kind which have happened in the metallic mines of Alsace. One of these mines—that of Gundershoffen (Lower Rhine)—was sunk upon a deposit of siliceous iron ore; the bed of the ore, which is situated at the depth of 19 metres (62½ yards), lies upon the marls of the upper lias. After several inflammations of the gas, without serious consequences, one occurred, in 1824, in a deposit similar to the above, but resting upon the upper beds of the Jurassic limestone, an explosion took place in 1832, and another inflammation, much less violent, on the 27th of June, 1846. Finally, the gas also took fire in March, 1846, in the veins of copper pyrites worked near Giromagny. From the circumstances mentioned in the notice, which I have the honour to present to the Academy, it appears that the inflammable gas of these iron mines, is the proto-carburet of hydrogen, which, in the two first localities, emanated from certain bituminous beds of the lias and oolite, upon which the deposits of Gundershoffen and Winckel rest, and rose through fissures in the works. At Giromagny, the gas probably came from the transition strata which enclose the vein.—M. A. DUBREUIL. *Comptes Rendus de l'Acad. des Sci.*

ACCIDENTS.

Colliery Explosion.—Fifteen Lives Lost.—It is our painful duty to report that a melancholy accident occurred at about one o'clock on Tuesday last, by an explosion in Polka Pit, at Merton, near South Hetton, about 10 miles from Sunderland, by which 12 men and 3 boys have lost their lives. Another boy is so much injured that he is not expected to recover. One horse and two ponies were also killed. The pit had been laid off work for about six weeks, from an overflow of water, and had resumed working about a week previous to the accident. Upwards of 100 men and boys were in the mine at the time of the explosion. The explosion was heard, but not seen by any other of the workmen in other parts of the mine, who are unable to state (so far as we can learn) under what circumstances it took place. Had the explosion been general in the mine, the whole of the workmen must have suffered. One of the undersurveyors, on hearing the explosion, immediately proceeded down the pit, and towards the place where it happened, with a view to extricate the sufferers. He was suddenly attacked by the choke damp, and was instantly overpowered and rendered insensible. Other persons by whom he was attended drew him back, and had him taken out of the pit. He remained in a doubtful state till next morning, when a favourable change took place, and is now in a fair way of recovery.

Old Park Colliery, Dudley.—E. Woodhall was killed by a fall of coal.

Shut End Colliery, Kingswinford.—B. Glazebrook had the spine of his back injured by a fall of stone.

Stourbridge.—A young man, named John Rollason, residing at Pensnett, and employed at the works of Mr. Gibbon, of Shut End, as an engineer, met with a singular accident on Tuesday last, by which he very narrowly escaped death by strangulation. It appears that he was following his customary employment, when his neckerchief, which was loosely tied round his neck, was caught by the lathe attached to the engine, and drawn up tightly—very nearly producing suffocation, and preventing his giving an alarm. Fortunately, one of the workmen had occasion to enter that portion of the works soon after the accident, and seeing the position of the engineer, immediately ran to him and severed the neckerchief with a chisel. A few moments longer duration of the dangerous position in which he was found, would necessarily have proved fatal. His neck was found to be much cut and swollen, but, under careful medical treatment, he is expected to recover. —*Birmingham Journal.*

Tweedale Colliery, Dudley.—H. Walton was killed by a fall of coal.

The Lost Men in the Inundated Coal Mines.—There are now some hopes of these unfortunate men being found; for, on yesterday week, the workmen employed at the Patrick Croft Colliery, in prosecuting their search in what is called the "Jig-up-Brows," found four of the lamps at the distance of 307 yards from the pit eye, where two of the Jigs met. The lamps had not been wet, and were empty, with the exception of one that contained a small piece of wick. It is supposed that, at this point, they had replenished their remaining lamps with the contents of those left behind, and then continued their course up the Jig-up-Brows—the entrance to one of which they had barricaded by pulling up the tram-rails and propping up the roof, &c.; and it is at the top of this Jig-brow that the bodies of the unfortunate men are expected to be found, as it does not appear that the inundation had reached to any extent beyond the entrance of the Jig that they had barricaded.—*Preston Chronicle.*

Delabole Quarry.—As W. French was boring a hole immediately under the chain which lifts the waggon up the quarry, the chain snapped, and, in falling, struck him on the head before he could get out of the way, and killed him on the spot. The chain was considered to be perfectly strong and safe. The jury recommended that the chains used for the purpose above-mentioned should be more frequently examined by some one appointed for that purpose.—*Pennance Gazette.*

LIGHTING THE NEW HOUSES OF PARLIAMENT.—On Thursday night, experiments for the purpose of testing a new system of gas burners, with which it is proposed to light the interior of the new Houses of Parliament, were made in Trafalgar-square, before a committee, and Mr. Barry, the architect. A branch, containing eight burners for consuming common gas, was introduced into the reflector at the south-east corner of the square, and which threw a most brilliant light, by which small print could be read at 40 paces. The result was considered satisfactory.

ABERDEEN RAILWAY.—We are glad to hear that the contractors on various parts of this line have received instructions to proceed with the works, and we have no doubt they will be generally resumed, as we have already intimated, without unnecessary delay. The opening of the Scottish Midland, and the completion of the entire through route from London, ought to operate as a strong stimulant to proceed with the whole line to Aberdeen, without the loss of a single day during the present favourable season. It will be observed that the traffic return has been issued by the company for the first time. The receipts afford a very favourable view of the business of the line in its present state, it being kept in mind that only the southern section is in operation, including the Arbroath and Forfar, and the new portion to Montrose and Brechin.—*Ibid.*

GEOLOGICAL SURVEY OF GREAT BRITAIN.

The importance of a correct knowledge of the geological character of a country, with a view to the economical development of its mineral riches, and the application of various soils to the purposes of local agriculture, as manure, &c., determined the Government, some years since, to adopt measures for a thorough geological survey, in connection with the Museum of Economic Geology; and we have now before us the second volume, in two parts, published by order of the Lords Commissioners of her Majesty's Treasury, of the memoirs and progress of the survey. The rapid progress which has been made, in the last 20 years, in geological research, advancing it from a crude undigested study, to a beautiful and correct science, has been, in a great measure, brought about by the researches of the professors employed on this survey, under the auspices of Government, not a little assisted by the progress of the railway system, in many parts of the kingdom, where, in deep cuttings and tunnels, the nature and dip of the strata have been beautifully laid open.

The first part of this second volume is occupied by a geological, physical, and geographical description of the Malvern Hills, compared with the Palaeozoic districts of Abberley, taking in a district, extending from Abberley, in the north, to the Tortworth district, in the south; a distance of 20 miles through the counties of Worcester and Gloucestershire, taking in the country on both sides of the Severn, above Chepstow, with the coal-fields of the Forest of Dean. This line, strongly traced by nature, passes at the foot of the Flintshire and Denbighshire Hills, winding by Shrewsbury, Bridgenorth, and Bowdley, and touching the Abberley, Malvern, and May Hills, strikes the Severn at Pyrtan Passage. On the west of this line, the whole region is mountainous, principally composed of the older classes of marine strata, mixed with various coeval rocks, the effects of local igneous action. On the east, extend immense breadths of less ancient deposits, pierced at a few points by the rocks, which rise higher and spread more widely to the westward.

Throughout the volume, the ample and lucid descriptions are beautifully illustrated by wood-cuts, showing the various fractured conditions of the strata, and the appearances and remarkable features of the most interesting hills. The highest summit of the Malvern Hills is 1440 ft. above the sea. The remarkable springs along this line have always been considerably interesting; they consist of four on the western side, two in the midst, and five on the eastern side; and the levels at which they issue vary from 674 ft. to 1227 ft., at temperatures ranging from 44° to 50°; they contain carbonates of soda, lime, magnesia, and iron, sulphate and muriate of soda; and are much frequented in the summer season. The agricultural character of this district is simple, producing, on the hills, good grazing land for sheep, and, on the smooth slopes, cultivation is carried on; the great proportion, however, of silica, in the composition of the rocks, renders the soil less fertile than what often results from the decomposition of trap. The memoir then proceeds to give ample descriptions, geographically and geologically, of every particular hill and feature in the district, for which we must refer our readers to the work itself, which, particularly to parties residing in the locality, will be found highly interesting. On a general comparison between the Abberley and Malvern districts, it is considered they offer so complete a similarity, in the characters of their stratification, as to leave no doubt of the former continuity of the deposits; they were doubtless deposited in the same oceanic basin; and the long subsidence, in one case, must be admitted in the other: very slight differences also in the distribution of organic life can be pointed out. In structural formation, however, there is a marked difference, the principal of which appears to be in the country adjoining the syncline of Malvern, where the strata is much bent, but hardly broken by faults. In the Abberley district, faults, as well as flexures, abound. Syncline is seen only at one portion of the northern range, while it forms the great feature of the southern mass. The strata, forming the upper and lower silurian systems of Sir R. T. Murchison, constitute a series of deposits of from 2000 to 10,000 ft. in thickness; and the memoir next proceeds to describe the fossils peculiar to this locality, consisting of gonoid and platoid fishes, *ameliida*, *crustacea*, *trilobitida*, *ostracoda*, *cephalopoda*, *heteropoda*, *pteropoda*, *gasteropoda*, *lamellibranchiata*, *brachiopoda*, and *echinodermata*, besides a variety of fossil plants; their characters and geographical distribution are amply described; and this part of the volume forms, in itself, a perfect work on the fossil geology of Wales, and the adjoining counties. It closes with a map of the districts described, and 30 highly-finished steel engravings, illustrative of the fossils.

The second part of this second volume commences with a paper by Dr. Hooker, F.R.S., "On the Vegetation of the Carboniferous Period," as compared with that of the Present Day," in which, after some introductory remarks, he observes—"The great extent of the vegetable kingdom is hardly to be appreciated, except by the professed botanist; and he must be an advanced student who knows as much of its main features as he may acquire of the animal creation during the course of an ordinary education. Every one, for example, is familiar with the divisions of the class *animalia* into beasts, birds, fish, reptiles, shells, &c.; but much study is required to attain an equal amount of acquaintance with the parallel divisions of plants into exogenous, endogenous, &c. The technical terms, too, employed in the one case are, very many of them, universally intelligible; whilst the majority of those applied to the more conspicuous organs of plants must be acquired by a special study. Lastly, the external organs of vegetables, and especially such as are generally available in the fossil state, are not the same guides to the affinity of the objects themselves, to their habits, or to the nature of the area they occupied, which the similarly conspicuous organs of animals are. Thus, were fossil vegetables much more perfect than they are, the information to be derived from their study will never hold a rank, of equal importance to the geologist, with that afforded by animal remains." The author then proceeds to show, that notwithstanding this discouraging view of fossil botany, it possesses facilities for the investigation of its vegetable remains, afforded by no other, owing to the vast accumulation of specimens, and to many of them being under very different conditions in under clay, the shales, in nodules of ironstone, and in sandstone. In the course of the paper, he considers the mutual affinities of the groups under which the majority of the genera range themselves. *Ferns* in the lower series; *conifera* in the highest; *sigillaria* the most important group, with *stigmara* their roots; *calamites* and *cycadea*. Their geographical distribution, relation between the soil and plants, and that the consequence of the existence of coal plants has been the formation of coal. All these points are treated with a master's hand. He shows, that in the fossil flora of the coal formation, there have been found 300 species; that vegetation was highly luxuriant, and has given a full description of the most prevalent genera, illustrated by wood-cuts. This paper is highly interesting, as are two others by the same author, nearly allied thereto—"On some Peculiarities in the Structure of *Stigmara*," and "Remarks on the Structure and Affinities of some *Lepidostrophi*." They are treated with equal ability, and we cannot conclude a notice of Dr. Hooker's able essays, without the following extract:—"I cannot conclude these desultory, and, I fear, unsatisfactory, remarks—the fruits of one short year's study in the vast field of inquiry to which they relate—without expressing a hope, that my observations on the discouraging aspect of the science, will not deter the beginner from pursuing his investigations; still less that they will lead the geologist to reject such information as the botanist can supply, because it has hitherto been incumbered with loose speculations on the affinities of the genera, distribution of the species, and value of the characters which the latter display. Too much has been expected from the botanist, who wants materials for those bold generalisations which the fossils of the animal kingdom so abundantly supply. Except to individuals who have great facilities for this study, the collection and examination of the wafers and strays of a by-gone flora is a forbidding pursuit. It can be undertaken to advantage only by him to whom the existing flora is, in some measure, familiar; and such a one cannot see the rapid advances in palaeontology, which are due to the exertions of the zoologist, without feeling a conviction, that some undistinguished geologist will expect more definite and immediate results from his labours than the specimens at his command may ever afford."

We next have a paper "On the Asteriade found Fossil in British Strata." These our geological readers know are the starfish. It is an interesting essay, and important, as through it we may hope to attain a knowledge of the earliest features of this important section of radial animals. Another paper follows, by the same author, "On the Cystideae of the Silurian Rocks of the British Isles." This is another fossil radiated animal, of which geologists knew but little, until within the last few years; and the manner in which the subject is treated at considerable length, shows much research.

The concluding subjects we have before noticed in the *Mining Journal*—"First Report on Coals suited to the Steam Navy;" "The Lead Mines

of Cardiganshire and Montgomeryshire;" "Report on Stones for Building the New Houses of Parliament;" and the "Produce of Lead Ore in the United Kingdom for 1845-6 and 7." This part of the work concludes with tables of the sale of copper and lead ores, which we have before given, and 36 exquisitely finished illustrations; these latter, equally with those above mentioned, in Part I., are perhaps specimens of minute line engraving equal to anything that art can produce. The volumes are printed on superior paper in the clearest type, and will prove an ornament, as well as works of interest, to any public or private library.

JEFFERY'S MARINE GLUE.

In our columns of July 1, we noticed the complete and satisfactory test to which this glue had been put on board vessels after six years' service—viz.: the *Talbot* and *Curacoa*; it has also been applied to nearly 100 of her Majesty's ships, with most complete success; and we have also noticed the gross injustice the patentees had been subjected to at the hands of the Lords of the Admiralty. We are glad to find that Capt. Pechell, in the House of Commons, on Tuesday night, brought forward the subject, with the view of protecting Messrs. Jeffery and Co. from the injuries which are still being inflicted on them.

It appears a statement had been promulgated in the *Times*—as coming from Lord John Hay—that the great fault of the marine glue was its disagreeable smell when used in paying the seams of the decks, and that he alluded to the old affair of the *Victoria* and *Albert*, when bilge water got a peculiar smell, by passing through the tarred felt used in the vessel, and not from the marine glue at all. We can tell Capt. Pechell something further about that "old affair of the *Victoria* and *Albert*." Sometime after the negotiation was concluded, Mr. Jeffery was, we believe, in Paris, when he received a letter from the authorities, requiring him to come and superintend the paying the seams of the mahogany deck. He lost no time in obeying his instructions; but, when he arrived, which was within one week from the date of the surveyor's letter, he found, to his astonishment, that the deck had been already paid two months, with some vile stuff, which had been made up in the Dockyard, to degrade the character of his glue. Mr. Jeffery remonstrated, and the material was, by his earnest desire, removed immediately; and he sent some of his own glue on board, to pay the deck, and to repair the injury which was likely to ensue from such unfair conduct, but in vain; it was rejected; and hence the report, which was made after the material had been removed two years, that the glue gave an offensive smell—these proceedings having, no doubt, been got up and promulgated by parties of high influence, interested in some way against the introduction of the new material.

Lord John Hay professed "that the Board of Admiralty were very anxious to do Mr. Jeffery justice; but the merits of the article should be tested before expense was incurred." Now, we would ask his Lordship, has not the glue been severely tested for the past six years in vessels on actual service, and stood every trial in a most extraordinary way?—or was it justice to allow these gentlemen to spend six years of their lives, and some thousands of pounds, for the benefit of Government, without one farthing return, even for travelling expenses? Mr. Ward said, "these discussions were very inconvenient." Yes; we know they are inconvenient, as showing up to the public the disgraceful favoritism and monopolising spirit by which some of our most important public establishments are conducted. He said the Board of Admiralty would give every reasonable facility, but objected to the claim of 30,000*l.* As to the latter, it is little more than the patentees have expended, taking into account their six years' continuous attendance on Government; and the latter would save more than that sum the first year. We trust, Capt. Pechell will keep the subject in view; for it is an absolute national disgrace, although perfectly notorious, that if any patentee, let his invention be ever so valuable, once gets into the hands of the Government "jacks in office," from the highest to the lowest, unless he has some friends at Court, he is treated in the same manner—favoritism and monopoly being the bases of their proceedings.

BRETT AND LITTLE'S ELECTRIC TELEGRAPH.

We are happy to be able to inform our readers, that this telegraph—on which we have always expressed our opinion, that it was not only the most simple in principle, and economical in first cost and working, but the most correct in its operation, as compared with any other, and which is now in use on the Whitehaven and Chester and Birkenhead lines—is about to be laid down on the Great Southern and Western Railway (Ireland). This will doubtless give it an impulse, which will extend it, not only to the railways in Ireland, but to England and Scotland; and the patentees, who are young men, are deserving of every patronage for the improvements they have made, and their persevering exertions in bringing those improvements before the public, regardless of expense. They have recently purchased the patent for a galvanic battery, taken out by Mr. Weir, of Birkenhead, which is, perhaps, the most splendid addition to the science which it has ever received. It consists of a range of porcelain non-conducting cells, with simple alternate plates of copper and zinc, connected by a strip of copper; between these are placed small pieces of sponge, in which is rubbed sand, saturated with chloride of calcium, and gently pressed down, until the cells are nearly full, which gives out very considerable galvanic power. The great advantages of this battery are, that no salt of zinc is formed, consequently there is no wear and tear; the power is continuous and regular, and may be said never to vary under any ordinary changes of the atmosphere; and chloride of calcium, having the property of combining with the moisture of the atmosphere, any evaporation which may take place is immediately compensated for from the surrounding medium. Under these circumstances, a battery might be locked in a box, with proper admission for air, and continue going for perhaps two years without ever having been looked at. The power is not quite so intense as with dilute sulphuric acid; but this is easily overcome by adding to the number of elements, when any amount of power may be obtained, and at no extra working expense, as there is, as we have before stated, no wear and tear. We were also shown a beautiful little arrangement for an electric telegraph machine, in which at the bottom of a light needle, made of a slip of tortoiseshell, working on an axis, is fixed a small diamond-shaped magnet, not heavier than a sixpence, and which, vibrating to either side of a coil of wire, reverses the position of the upper point of the needle, acting precisely on the old galvanometer principle; and, notwithstanding the delicacy of these materials, we understand they have been, for some time, working with considerable success. Messrs. Brett and Little appear now to have the goodwill of the public; and we trust they will soon reap those solid advantages which we think they merit.

THE PATENT DOMESTIC TELEGRAPH.—The application of the principle of the electric telegraph to domestic purposes, by Mr. William Reid, as noticed by us some weeks since, in a paragraph taken from the *Birmingham Advertiser*, could not have failed to attract the attention of our readers. Since then we have been favoured with a private inspection of several sets of instruments made by Mr. Reid, by which we perceive that he has effected some important improvements on his original plan, and extended the use of the instruments—the sets under notice being applicable to hotels, taverns, tea-gardens, coffee and chop-houses, public companies, and private houses. We have already given a description of the instrument in the paragraph alluded to. The alteration, to suit the various purposes contemplated, is confined to the dial-plate, on which the specific questions and demands are disposed in due order. Independent of its utility, the instruments, which are from 18 in. to 20 in. high, are classically designed, and form a handsome piece of furniture for the drawing-room, the board-room, the parlour, and the ladies' boudoir. In the board-room, and large mercantile and manufacturing establishment, and in the country mansion, its secret and instantaneous services will be found highly advantageous; and we were particularly struck with the idea, that in a great variety of instances, it might be highly beneficial for mining purposes, as it might be found a most useful auxiliary, and be the means of warding off, or giving timely notice of apprehended danger. Its uses would be very important in transmitting orders, and receiving information from distant parts of the mine, where time and labour are objects. The domestic telegraph is so simple in construction, that a child may work it; it supersedes the necessity of having a servant constantly at the elbow, or communicating orders of a confidential nature through clerks; it conveys orders and messages instantaneously, effectually, and in silence, and, it is probable, that the time is not far distant when it will be generally adopted in our coal and mining districts, and wherever, by its timely warning, danger can be averted, difficulties overcome, and comfort or convenience ensured; under all such circumstances, its services will be duly appreciated—in short, there is hardly any purpose of life but in which this instrument may be enlisted, and successfully and profitably applied.

Original Correspondence.

COPPER.

SIR,—The profits of copper smelting are, no doubt, very great; and this view is confirmed, on considering that the immense waste of valuable substances contained in the copper ores has hitherto been deemed of slight importance. About 12½ tons of copper ore are smelted for every ton of fine copper produced; and these 12½ tons are composed, on an average, thus:—Copper, 1 ton; iron, 1½ ton; sulphur, 2 tons; siliceous and other earthy matters, oxygen, moisture, &c., 8 tons—together, 12½ tons. Thus, for every ton of copper produced, 1½ ton of iron is rejected, and 2 tons of sulphur, either thrown away in the scoria, or dissipated in the operations of smelting. Two tons of sulphur will suffice to form 5 tons of sulphuric acid, worth 3*l.* per ton; and 1½ ton of iron is worth at least 5*l.* Thus, materials, which would produce 15*l.* worth of acid, and 5*l.* worth of iron, are wasted in the production of one ton of copper—or, in other words, there is a destruction of 20*l.* worth of materials for every ton of copper smelted. If we estimate the whole quantity of pure copper produced in this country, during the past 48 years, at 1,000,000 tons, there must have been, during that period, the enormous waste or destruction of iron and sulphur amounting in value to at least 20,000,000*l.* sterling. The iron thus wasted is equal in quantity to the full make of the 18 blast-furnaces at Downis for a period of 20 years; and this iron would lay down 3000 miles of railway.

Copper ores, though containing a large per centage of sulphur, are so constituted as to be in general infusible, unless the ratio of their constituents is first altered by calcining them, so as to dissipate a portion of the sulphur. To effect this change, the ores are subjected to the first operation of calcination; and this is necessary, not because the sulphur dissipated would, by its presence, retard or lessen the effect of future operations, but solely to give a degree of fusibility to the ore, and which is chiefly brought about by the peroxidisation of a portion of the iron, set free from the sulphur, during calcination.

The Cornish ores, in their uncalcined state, are remarkably infusible; so also are the ores of Tigrany, Cronebane, Allihies, and Knockmahon. The Welsh ores, and those of Ballymurtagh, are more fusible. When the calcined ore is subjected to fusion, the liquid matter divides itself into two strata, of different specific gravities; the copper is found in the lower or denser medium; and the siliceous slag of iron, containing a mere trace of copper, constitutes the upper stratum. When the fusion is effected in a crucible, and the contents are suffered to cool, the regulus, or lower stratum, divides itself completely from the supernatant scoria. On the large scale, the scoria are raked, or skimmed, from the surface of the regulus. Now, it is clear that, for a given weight of calcined ore operated upon, the greater amount of scoria obtained, the richer in copper will the regulus be found, and *vice versa*. Thus, if from 100 parts of calcined ore, containing 9 per cent. of copper, we obtain by fusion 30 parts of regulus, this regulus will contain 30 per cent. of copper; but if we obtain only 20 parts of regulus, then this latter regulus will contain 45 per cent. of copper. The great object, then, in fusion, is to obtain as small, and, therefore, as concentrated, a quantity of copper regulus as possible from a given weight of ore, keeping, however, in view that there must always exist a proper degree of levity in the scoria to admit of the regulus subsiding to the bottom of the crucible, or furnace. Now, if the whole of the sulphur combined with the copper can be at one fusion separated from it, the addition of a portion of carbon will leave at once the metallic copper separated from the superincumbent slag, and fit for being at once transferred to the refinery. By the present methods, this object is effected by three or more roastings and fusions of the regulus—each operation reducing the quantity of alloyed impurities, and bringing the regulus nearer and nearer to the state of copper fit for refining; but in these operations the separation of the reguline matter is not so distinctly marked as in the first fusion; and, also, a portion of the copper becomes oxidised, and is carried off in the scoria—so that the scoria of the latter operations have to be transferred back to the first and second fusions, in certain proportions, and added to the charge; and the oxide of copper contained in these slags is decomposed by the peroxidisation of the iron, set free from its combined sulphur. Now, by the attentive consideration of the chemical and statistical conditions of the first fusion, I find that, by a proper adjustment of fluxes added to the charge, the quantity of regulus resulting from a known weight of ore may be diminished at pleasure, and its richness in copper increased in consequence; whilst by carrying out the system to its fullest extent, and by a certain addition of carbonaceous matter, the copper may be at once obtained so pure, as to contain not more than 2½ per cent. of iron—an alloy readily got rid of by oxidisation in the refinery; thus, the expensive and tedious operations of recalcining and remelting may be avoided, and the cost of smelting may be reduced to about 6*l.* per ton. Copper, like iron, is capable of combining, to a certain extent, with carbon; like iron, also, it is in its most ductile state when combined with a minimum dose of carbon. If the dose of carbon be increased, or if the metal be wholly freed from carbon, it becomes far more brittle, and less malleable.

When suitable fluxes cannot be economically provided, to separate the whole of the impurities of the ore from the copper at the first fusion, a rich regulus may still be obtained, containing from 30 to 40 per cent. of copper; and this may, by calcination in ovens, with access of atmospheric air, be wholly desulphurised at one operation; and the residuum, consisting of oxides of iron and copper, combined with some earthy matter, will afford, by simple fusion with carbonaceous matter, copper, alloyed with a small per centage of iron—care being taken to add no more carbon than will revive the oxide of copper, without acting upon the more refractory oxide of iron to any injurious extent. I think the intelligent body of men, by whom the copper smelting is said to be monopolised, are often, as it were, attacked for possessing that skill and knowledge which enables them to effect profitably those operations, which the mere capitalist, deficient in skill and experience, cannot, without loss to himself, undertake to direct. Are the copper smelters to blame, because they wish to enjoy the fruits of their knowledge and experience? or do they forbid any capitalist from entering the lists of competition with them? Want of knowledge can be the only obstacle to the success of a capitalist embarking in the copper smelting trade, and that want of knowledge cannot be laid to the charge of the present members of that branch of trade. Knowledge is power, and money may prove an auxiliary aid to power, though it cannot create that power. The power of the copper smelters lies in their knowledge—not in their capital, or in their natural advantages of locality. The same power enables the old established ironmasters to carry on their works to profit; whilst inexperienced capitalists, from time to time, lavish tens of thousands, in situations often far superior to those of the old iron-works, and realise nothing but anxiety and final disappointment. ROBERT MUSHET: Coleford, August 15.

INDIAN IRON AND STEEL.

SIR,—In my letter, respecting Indian iron and steel, inserted last week, the words in the four concluding lines bear a construction which I never intended they should. The passage should stand thus—"Neither are they (the remarks) made with a view to lessen Mr. Radley, nor yet to exalt the merits of Mr. Heath unduly; with the latter intention they would, indeed, be superfluous."—ROBERT MUSHET: Coleford, August 14.

IRON AND STEEL.

SIR,—It is in vain that I should seek further to elicit facts from Mr. Mushet, in proof of his extraordinary theory of the strength of cast-iron; I must leave it to the judgment of practical men in the broad form in which it was first propounded—viz.: that an imperfect degree of cementation in the blast-furnace yields an heterogeneous compound with malleable iron, which produces strength; and, on the reverse, when in the blast-furnace, the cementation is effectually performed, as in the Scotch manufacture, producing homogeneity of quality, the pig-iron is of a weak, inefficient strength; but we are now told that a more complete degree of cementation induced upon pig-iron in the air-furnace, gives that homogeneity which is an essential character of strong castings. With respect to china ware, it is fully as much judged of as cast-iron by its appearance; and the makers of porcelain are accustomed to estimate to the utmost nicety by the eye if the ingredients have been properly compounded.

I have not at present a crucible at command; therefore, the question of the uniform levity of malleable iron, above a certain temperature, must rest undecided. But I would make two remarks on the instance Mr. R. Mushet has given. First, there is a mechanical levity arising from their form in abraded fragments, which may permit them to float on a fluid of similar specific gravity, though their absolute specific gravity may, in fact, be greatest. The second remark is, that I very much doubt if such frag-

ments, immersed in liquid cast-iron, will remain in the state of malleable iron—that is, according to the usual acceptance of the term, *destitute of carbon*. The rest of this paragraph is a contradiction; for whereas he has asserted that certain effects are produced by the levity of malleable iron floating upon pig-iron, he now asserts that this levity is not sufficient to create a bi-form monster in castings of material depth, although we know that a body of less specific gravity will always rush to the surface of a heavier fluid with velocity, proportioned to the depth and consequent pressure. The bi-form monster is to be confined to shallow pig-iron alone, where alone Mr. R. Mushet wants it. Whether work made with mottled or grey iron is the stronger (*i. e.*, the least brittle), was a question I put, that Mr. R. Mushet might then solve the ambiguity—not, I should think, a difficult point for one so abstrusely learned in these matters. Mr. R. Mushet must have paid but little attention to the freezing of water, or the crystallisation of any salt, from the remarks he offers on that subject. Let him immediately repair to the nearest chemical works, and add to his knowledge, by searching the mother water of crystallisation; but, if he is favoured by no such opportunity, he must await the winter, and watch the formation of ice.

A difference in the structure of the under and upper surfaces of finer metal may be accounted for by the very different process of cooling in those respective positions, and could not fairly be held to prove any of the metalliferous branches of the malleable alloy strength theory. The rest of this paragraph confuses or mistakes entirely my observations, and it is evident Mr. R. Mushet's metaphysical peregrinations have not revealed to him an event which consisted not in the quickness, but the stateliness, of the performance. Notwithstanding the ignorance of "Ferrous" and Mr. Wrightson, Mr. R. Mushet may find, in the *Mining Journal* of last May twelvemonth, something very like a knowledge of apparently white-iron having the characteristics of grey. Mr. R. Mushet said nothing about fusing pure iron with an oxidisable substance. What Mr. R. Mushet said was, that if malleable iron were fused with oxide of iron, its fusibility would be increased, proving it had become pure by the operation; to which I replied, there was no proof because malleable iron is more fusible when alloyed with its own oxide.—FERREUS: August 14.

PURE IRON.

SIR,—In the *Mining Journal*, of the 22d April, your correspondent, Mr. R. Mushet, says:—"With 3 per cent. of carbon graphite begins to appear, which is, I believe, a definite compound of iron and carbon in equivalent proportions." Now, Mr. J. M. Heath says, that "graphite contains no iron." How will he reconcile this assumption with his own belief, or with the idea that Mr. Heath is an eminent metallurgist? Does Baron Coleford mean the public to infer, from his peroration to Mr. Leighton, that a button of pure iron was never seen before his lordship produced it? Then, again, I should like to know the particulars of the method whereby this pure iron was carbonised (carbonated, he says, which means combined with carbonic acid), whether in the state of filings, laminated, granulated, or how prepared for cementation, and then how treated? Further, I would have his lordship explain the apparent tergiversation of the sentence in the third paragraph of the same article:—"The Danemora (*i. e.*, Swedish iron) contains, in addition, about 15 per cent. of manganese, which constitutes its only defect! Manganese may sometimes improve inferior iron, but it always deteriorates pure iron;" with the eulogistic appropriation of his father's sentiment about Mr. J. M. Heath's method of conferring the property of welding on cast-steel, thus—"I allude to Mr. Heath's process for conferring the welding property on cast-steel, and improving, at the same time, the general qualities of that invaluable material," and say whether he thinks that steel is so far removed out of the category of iron, as to be worthy of this play of language; and, if so, how the late Mr. Mushet could record the assertion in the *Philosophical Transactions*, that the following table represents the relative affinities of iron and steel:—

	Carb. Iron.		Carb. Iron.
Soft cast-steel	1 to 120	Black cast-iron	1 to 30
Common	1 " 25	White ditto	1 " 25
Harder	1 " 100	Mottled cast-iron	1 in 20
Hardest	1 " 50		D. MUSHET.

Perhaps Mr. R. Mushet will tell us the compenion, melting point, and specific gravity of the best blistered steel. WILLIAM RABLEY, Ch. E. London, August 16.

ON THE MANUFACTURE OF SULPHURIC ACID.

SIR,—The improvements in the manufacture of sulphuric acid have been so great, that the manufacturer, in some localities, can now make this acid of specific gravity 1.750 for 3d. per lb., which almost precludes the idea of the manufacture being susceptible of any further improvement; but that it has not yet reached perfection, we have the evidence of some of the most distinguished French chemists, in behalf of M. Schneider's recent invention. It appears that this invention consists of two parts—one being the dispensing with nitric acid, or a nitrate—the other with large lead chambers. In consequence, however, of the low price of nitrate of potash and nitrate of soda, coupled with the fact, that the celebrated chemist, M. Gay Lussac, having lately patented an improvement, by which the nitrates of the alkalis are economised to the extent of 66 per cent.; and also from a more recent patent, which, although it does not effect so great a saving of nitric acid, yet, by making a mixture of nitrate of potash, china clay, and sulphuric acid, the product, after being lixivated and crystallised, is of equal value to the materials employed, instead of being a loss (if the value of the disengaged nitric acid be excluded) of 21l. per ton. But this patent does not lay claim to any reduction in the size of the lead houses—the space requiring to be 20,000 cubic feet, to make, in a week, 24,052 lbs. of sulphuric acid, specific gravity 1.347, by the consumption of 198 cwt. of iron pyrites, and 8 cwt. 0 qr. 10 lb. saltpetre, mixed with clay, and the equivalent quantity of vitriol. It is here, therefore, that ample room appears for improvement; and if M. Schneider can produce as much sulphuric acid in 1/10th the space, notwithstanding the present low price of lead, every chemical manufacturer ought to hail his invention as a boon. If the enormous sums squandered in railways in the west of England, could have been diverted to erecting vitriol chambers, for turning to account the vast natural advantages which Cornwall and Devon possess, the Cornish miner need not now have much to fear from the competition of other countries in copper ores; but it may not be too late, if his energies are directed to grapple with the impending difficulties of his position, by speedily introducing improvements, while the duty still remains on foreign ores, before that duty becomes of very little protection to him, either because of the earlier adoption of improvements in foreign countries, or from the large importation of colonial ores.

August 17.

WILLIAM BIRKMYRE.

SULPHURIC ACID.

SIR,—I have just read the following notice in the *Mining Journal* of last week:—"M. Jobard, the director of the Museum of Industry, at Brussels, has announced the arrival, in London, of Mr. Schneider, a distinguished manufacturing chemist, the author of an invention of the highest importance, and calculated to promote the advancement of science. By this new process, we are informed, the sulphuric acid is produced without applying any nitric acid, or the nitrates, and without employing any of those enormous lead rooms hitherto in use. This valuable discovery has been highly approved, and honourably praised." &c. Referring to this notice, I beg to state, that I have, for many years past, been endeavouring to direct the attention of the mining community to the increased value which some minerals, as munda, &c., now regarded as mere refuse, would acquire, if improved chemical processes were applied to their treatment. It is now more than 10 years since I arrived at the conclusion, that the combustion of sulphur was analogous to that of carbon; in a first combustion the latter forms carbonic oxide—the former, sulphurous acid; and that, since carbonic oxide is, by a second combustion, converted into carbonic acid, so, by a second combustion, sulphurous should be converted into sulphuric acid. I have followed up this conclusion, and matured plans for producing sulphuric acid, either from pure sulphur, or the metallic sulphurets, simply by combustion, or the action of air. I did anticipate that I might, at some time, have derived a little pecuniary benefit from this invention; but, as a foreigner is about to introduce a plan for this purpose, I am induced to communicate mine, through the medium of your columns, to those parties who take an interest in such pursuits. The combustion of carbon, no doubt, produces carbonic acid directly, under certain conditions; and sulphuric acid may, too, be obtained at once from the combustion of sulphur, or a sulphuret, although more difficult to treat than carbon. I have not tried the operation, but have little doubt as to the result of mixing sulphur, or a sulphuret, with a large portion of incombustible matter, more particularly a metallic oxide, and a well-regulated application of air, to contrive slow combustion with an abundant supply of air, and that thus sulphuric acid would be directly obtained. My great aim has always been to make

use of the metallic sulphurets, and as these frequently contain arsenic, it became necessary to effect a perfect separation; I, therefore, contrived the following arrangement:—

I propose to work a furnace, kiln, or oven, for burning off, at a low heat, the sulphur, arsenic, or zinc, by blast. The vapours are then to be conveyed through an extent of condensing flues, or chambers, sufficient to cool them down to the solidifying point of zinc and arsenic, or their oxides. To avoid the inconvenience of a great extent of longitudinal flues, I propose using a series of ascending and descending flues, or chambers, from the lowest points of which the zinc and arsenic are to be removed occasionally; heated air is then to be blown in, to meet the cool sulphurous acid. I have not determined the temperature for the air necessary to consume, or for the oxygen to combine with, the sulphurous acid, but the heat used for the hot-blast of iron smelting furnaces must be more than sufficient. Sulphuric acid, in its dry state, will be thus formed, which will condense into liquid acid, upon coming into contact with water—either as a stratum, at the bottom of the flue, falling in small streams from the top, or thrown in, in vapour, as steam. In cases where it would be more desirable to obtain sulphur than its acid, sulphurous acid may be decomposed in more ways than one—the simplest being to throw in heated deoxidising gases instead of pure air.—T. H. LEIGHTON: *Cumnamon*, August 15.

UNIVERSAL BLOW-PIPE.

SIR,—By no means wishing to depreciate Prof. Herapath's excellent blow-pipe, referred to in one of your recent Numbers [*see Mining Journal*, May 13]; quite the contrary; but desirous only of reclaiming my own right to register, if so disposed, one on a like principle, in which I have made a great improvement, by the graduated admixture of air with the gas, before coming up to the blast; may I ask you to reprint a letter of mine in your *Journal* of February 6, 1847?—an editorial note to which refers to my then great experience. How long before that time I brought it into practice is not necessary, at this moment, to examine. I think it was about 1830; and it appeared new to all who saw it at work. J. PRIDEAUX.

SIR,—In reply to your correspondent's question, respecting can safety tubes for the oxy-hydrogen blow-pipe, I should not like to trust such bad conducting materials, as on this property the safety appears to depend, though they might work a good while without exploding. But whilst we have a perfectly safe, and much simpler, contrivance in Professor Daniell's concentric jet (to be obtained at any apparatus shop), all this package may well be dispensed with. This jet I am in the constant practice of using, with coal gas and common air—producing much greater heat than is requisite for drill tempering, without the expense of oxygen and hydrogen gases. The central aperture, for air, must be proportionately larger than for oxygen; and the dimensions of the whole must, of course, be proportionate to the work. The air-hole of mine is about 1-14th inch, and the gas circle one-quarter in diameter, and full 1-20th in fissure, and this will work glass tube five-eighths in diameter; the air is thrown on by double bellows; the gas flows from the town pipes at a much lower pressure. The nozzle is a little lengthened beyond the air-hole. Feb. 5, 1841. I remain, &c., J. PRIDEAUX.

[The practical experience of our correspondent attaches a weight to my communication emanating from him, which we are the first to appreciate, and which feeling alone prompted our putting forward that gentleman's name as an authority desirable to consult. We have to thank him for the readiness he has evinced in complying with our desire.]

COPPER SHEATHING—No. III.

SIR,—The increasing attention to this question in your columns is both gratifying and promising; I proceed to notice the letters in their order, and as concisely as their value will allow. The case of the Norway ships, given by "Germanicus," is of great interest: can he refer us to the times, places, and particulars, and put me in the way of getting some of this proved sheathing, for examination? In reference to Uzielli's patent, tin-alloyed copper (whether under that patent I do not know) has been tried, and the failure was, its tendency to foul—as in the case of Davy protectors. His estimate of tough cake, at 96 to 97 per cent., pretty well coincides with my analytical results, which generally give the alloy under 2 per cent. in sheathing, consisting of new copper, mixed with four or five times its weight of old, which has been again refined. In the determination of the best alloy, by comparative analyses of worn samples, distinguished for durability, and for the reverse, there is a difficulty to which he has not alluded—viz.: the uncertainty how much of the waste, or of the durability, is really due to the intrinsic quality of the metal, to its mechanical condition, or to external circumstances, as noticed in my first letter on this question. In 15 samples analysed, and upwards of 50 subjected to corrosive re-agents, and electro-chemical investigation, with attention to the protective, or destructive, electro-chemical influence of the nails, and too many other conditions to be here enumerated, which, with every facility of means and information, have formed part of my occupation for the last eight years, no sufficiently consistent results have been attained, to claim confidence, owing, in great part, to this uncertainty. In the hope of determining this question, I have fixed about 25 distinguished samples upon a buoy in the tideway, under conditions as nearly identical as possible, and with nails of known quality. These may, probably, require yet another year of probation; and, in the meanwhile, a discussion of the practical differences and changes of the smelting details, may throw light, not upon the sheathing products only, but upon the applicability of different processes and products to different purposes. "J. J." in the next letter, seems disposed to charge me with evasion and inconsistency—he will not find it so. My second is plain enough, if read with attention and candour, and public information, better than private, because open to the consideration and correction of practical men, as well as of the chemist, where facts may correct theories, and, like flint and steel, strike light on each other. It is not worth while further to notice what relates merely to myself; time will test our consistency and motives; we will, therefore, pass on to the really valuable parts of his letter—the practical points.

The injury to the quality of metal, by calcining the ore in heaps, is new to me; and I should be disposed, until better informed, to attribute it to mismanagement, for the reasons given in my No. 2; but it may be that the greater current of air in the reverberatory, more than compensates its greater penetration and gradual action in the heap. If "J. J." will say when and where this injury took place, we may, perhaps, obtain more light on the subject. "The continent" is, of course, too wide a limit; for though producing some bad enough, yet he may find, if not already aware of it, that as good and pure copper is made there as the "best selected" that is turned out at Swansea.

Witness the following analyses, not mine; but by a skilful hand:—

	Copper.	Silver.	Iron.	Calcium.
Dillenberg	99.84	0.06	trace
Staden-Berge	99.86	0.06	0.055	0.059

and neither lead, tin, zinc, manganese, nor sulphur.

He says, "all smelters use the same process." In principle, no doubt, as said in my No. 2; but, if in detail, there must have been much greater "modifications" than his letter implies, even since 1841. The older accounts speak of the different houses as differing in the details of their operations, which is confirmed by the differences in their slag heaps. In Mr. Vivian's description, published in 1823, two of the operations described are stated to be then usually discontinued. Of the different smelting-works at which I was intimate in 1841, no two corresponded in all the details, and no one exactly with Mr. Vivian's description; and it is in these details that the comparison of theory with practice has the best chance of improvement. If, however, they are now all agreed, will "J. J." give us the details at present so uniformly practised? or if, as I expect, he finds it otherwise, will he, so far as he feels himself at liberty, point out the differences, with their motives, advantages, or disadvantages? His question on the results of analyses is answered above to "Germanicus," so far as my present knowledge allows; and I shall be glad when the results of the experiment there mentioned, with the progress of the present correspondence, allows me to do it more satisfactorily.

With respect to the "co-operation of employers," that which will best elucidate the subject is most to our purpose, without regard to rank or station; but it may be right to repeat, that I do not wish workmen to betray their masters' secrets, nor feeling myself at liberty (without especial permission) to publish what was so liberally and kindly laid open to me in 1841. But those items, which "are so familiar," as not to "appear worth telling," are likely to be just what will shed most light, when brought out together, in practical and scientific collision. The last letter on this subject is signed "A Smelter and Refiner," and being a reply to another (not mine), my apology for meddling with it must be found in the heading. On this ground, he will excuse me for asking his meaning in the expression, "calcined till the sulphur disappears." I apprehend it cannot mean till there is no further evidence of sulphur, even in the smelt; for in that case the greater part, of both copper and iron, would be in a state of oxidation, and much copper would slag off in fusion, for want of sufficient excess of sulphuretted iron to decompose the oxide of copper, as explained in my second letter. I understand it to mean until the smoke becomes transparent, which I likewise think too far for ore cal-

cination, as a general rule. There may be ores, or mixtures of ores, for which it answers; but unless you have a very considerable excess of sulphuretted iron over the copper oxidated in calcination, the deoxidation of the latter, in the melting furnace, amongst the mass of stony matter, will be rendered incomplete by the "influence of proportion" (see, again, my second letter); and, although a rich regule of "coarse metal" will come out, the slag will not be clean of oxide of copper. This, however, is theory, only confirmed by observations, so far as my opportunities have gone; and if the writer has found, in practice, that his precept, thus interpreted, answers as a general rule, theory must follow, and employ itself, not in disputing, but in seeking the reason, and endeavouring to turn it to improvement. I hope, therefore, he will explain his precise meaning, and say how far he has proved its truth.—J. PRIDEAUX: August 17.

COPPER SHEATHING, ITS WEAR AND TEAR.

SIR,—In your valuable *Journal* of last week, your correspondent, "Germanicus," states, that Norwegian vessels, sheathed with copper from the poor ores of the mines of Rorås, near Drontheim, and which is never free from sulphur, have been in service 20 years, their copper scarcely worn, and that, to ascertain the cause, he recommends that the copper should be analysed. Allow me to state that, if the continental copper was analysed before being used, it would be found to contain no sulphur. I perfectly agree with him, as to the fact that much of the sheathing in England does not last above four years; and I stated, in my last, that much of the sheet-copper made in this country was much subject to lamination, which is doubtless the cause. I am satisfied that, from all classes of copper ore, by proper treatment, refined copper can be produced, of a quality suitable for all commercial purposes, and a metal the most to be relied on for sheathing purposes. This, as I have before stated, all depends on the refinery; and no one can be said properly to have refined his copper until it has reached a produce of at least 96 per cent.; and such metal is generally, I am certain, free from all complaints. All inferior copper sent into the markets, and of which so many complaints are made, has, I should say, come through the hands of parties who profess to be, but are not, proper refiners. Swansea, Aug. 17. SMELTER AND REFINER.

THE FORMATION AND DIRECTION OF MINERAL VEINS.

SIR,—The opinion is entertained by mineralogists and geologists generally, that the courses, or fissures, containing metallic substances, called in Cornwall *lodes*, or veins, were occasioned by the convulsions or contractions of the earth, and afterwards filled with mineral, or metallic matter, from the surface or interior of the earth's crust; but there seem to us many difficulties attending this theory. First, by whatever means the fissure might be made, if made at all in this way, it is evident that one side of the lode would be found to correspond with the other in appearance, which is seldom or never the case. Sometimes the lode has a wall on one side only; at other times, the both sides are irregular and uneven, without the least degree of similarity or agreement. Again, lodes sometimes vary from each other several degrees in their bearing towards a vertical position—and thus sometimes form a junction at a certain depth. In such a case, how can be accounted for the support of the superincumbent mass between, while these courses were being filled? Any convulsion in Nature is a disorder, or Nature working out of its ordinary mode—to produce which there must be at least some temporary derangement of one of its general laws; this applies to matter below, as well as above the surface. The structure of the earth may have undergone changes in this country, as well as other parts of the world, since its formation. But the lodes of this country are not generally characterised by disorder, but by regularity and order, which will be seen, if we compare their leading features, their structure, and direction, with what we know of the effects of convulsions by earthquakes and volcanic eruptions, furnished us by the history and geography of the world. If we consider the direction of the metallic courses in this country, approaching to uniformity as they are, we have strong presumptive evidence that they are not the creations of misrule. Cracks, occasioned in the earth by convulsions, might be found in the same district, bearing to almost all points of the compass, which is not the case; there is a uniformity in each district to within a few points of east and west, or north and south. We believe, therefore, that the great laws which are known to govern matter now, had their influence on lodes at their formation; and this was at the time when these laws would be most powerfully felt, when the lodes, as well as the surrounding strata, was in a state of fluidity, or dissolved atomic mass. Whether electricity and magnetism be distinct, or modifications of the same principle, we believe they had their influence in giving metallic veins their direction—electricity acting most powerfully on the east and west, and magnetism on those of the north and south course. For as it is proved by science that copper, zinc, and their kindred metals, are the best to be employed for concentrating, developing, and conducting the electric fluid, while iron and some others have greater affinity for the magnet, it is reasonable to suppose that the ores of these several metals would be influenced accordingly in their forming or deposition. This fully agrees with the fact, that the copper lodes of this country are most often approaching to east and west; and iron is as often north and south. We are aware that there are exceptions to this, in the St. Just and some other districts. Copper lodes are found to vary only a few degrees from a north and south course. These exceptions we account for solely on the ground that, at the time of formation, some local circumstances, or some chemical combinations, were wanting in these districts to evolve electricity, and produce a current—consequently, the polar force had the entire control of metallic matter; and this view of it is supported by the fact, that copper lodes in the same district are not found intersecting each other east and west by north and south; but generally partaking of the same direction in the same district. What miners designate *caunter* lodes, appear to be branches striking off from one lode and falling into another. This direction might have been produced by the electric current passing from one course to another; for it is very probable that this imponderable, like any other denser fluid, might, under certain circumstances, show a disposition to sport from one current to another. It is supposed by some that *cross-courses* have originated from some subterranean movement, causing a disruption, and moving one part of the earth, north or south, as it may be, from the other. This theory has been adopted to account for the heaves in the east and west lodes; but it should be observed, that the strata surrounding the cross-course, always corresponds on one side with the other, with only such exceptions as occur apart from, as well as near the cross-course, which could not be, if the whole country had been transferred north or south. Experiments in electro-magnetism, by Prof. Faraday and others, have shown that, when these agencies are brought into contact, they always act in a transverse direction—that is, if the conducting wire of an electric battery be brought near a magnet, the magnet will be attracted; but, if left free, will instantly and permanently assume a position directly across. If we apply this principle, it will at once explain the right angled direction of lodes and cross-courses. It is known that cross-courses always cut through the lodes at the point of meeting, sometimes causing a great deflection, or heave, of the east and west lode, which was occasioned probably by the magnetic or polar force being more powerful than the electric; and this hypothesis is supported by the fact, that lodes are often on their approach to a cross-course deflected several degrees from their ordinary course towards their position on the other side; a careful observance of this, as well as the stain the lode often makes in the cross-course between the heave, will generally determine in what direction the lode is heaved. This also refutes the opinion, that the lodes on different sides of the cross-course were formed by mechanical movements of the earth at different periods; for the deflection and strain we have spoken of connect them in their formation, making them one in point of time—only the one yielding to the superior power of the other.

The miner has already penetrated to a very considerable depth—without, however, cutting out these veins; and, according to the theory adopted, however great their depth, all metallic veins must be regarded as of subsequent formation to all surrounding depositions, excepting only the alluvial deposits; but we consider them contemporaneous with the systems in which they occur; and, whether they are found in rocks of igneous or aqueous origin, they took their direction and general form when the metallic and mineral substances composing the lodes themselves, as well as the surrounding strata, was in a state of fluidity, or atomic yielding state; and that they owe their vertical position partly to the same influence which gave them their longitudinal.

It is well known that the principle of affinity by which all matter adheres to and combines with its kindred matter, exists in different degrees and proportions in different kinds of matter; and this principle, as well as gravitation, is more powerful in metallic and some mineral substances than in common earthy matter: thus it is easy to see that, whilst common earthy substances, possessing a comparatively weak affinity and gravita-

